



4400

REVERBERATION SYSTEM

OWNER'S MANUAL

a gulton company

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1. Introduction

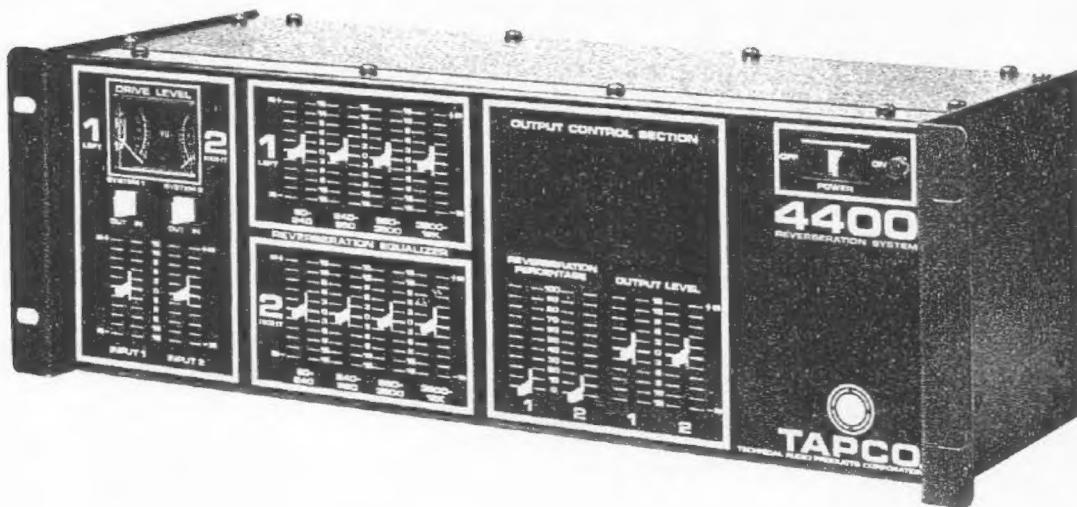
The 4400 Reverberation System represents the new state-of-the-art in low cost reverb systems. The many design innovations incorporated into the 4400 have given it the kind of flexibility and quality you would expect only in systems costing many times more. Complete compatibility is inherent in the design of the 4400, so it can be used with all common sound equipment. And like all Tapco products, the 4400 is built to withstand the rigors of professional use, day in and day out, in the studio and on the road.

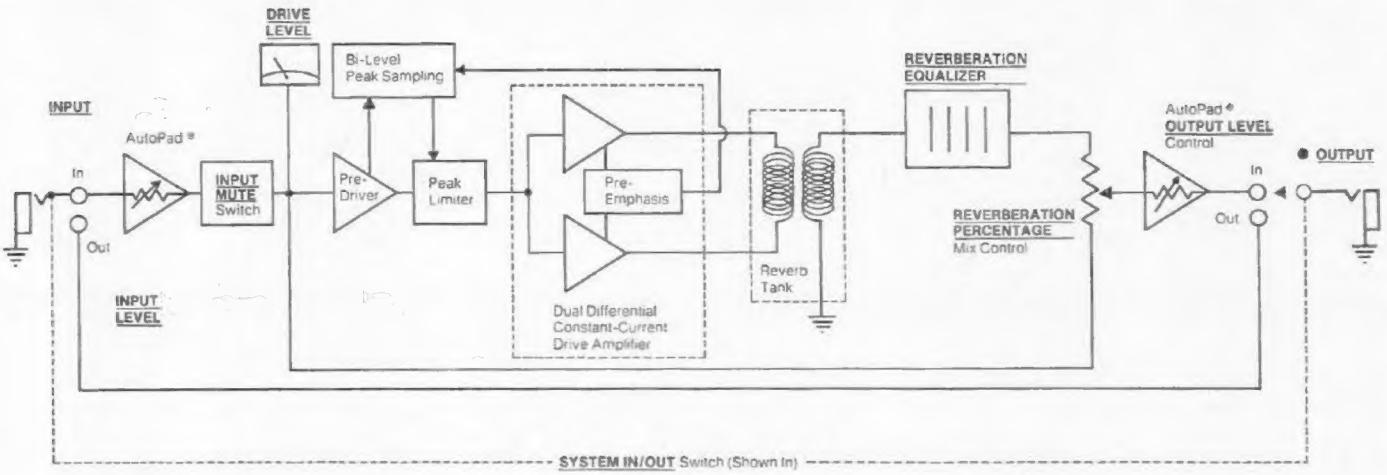
Reverberation, or reflected sound, is a part of everything we hear. So much so in fact, that we are not even aware of the reverberant sound unless it's missing. A room with very little apparent reverberation (or ambience) is usually thought of as being "dead," and this is what most recording studios sound like. The whole idea behind modern recording methods is to eliminate as much room ambience as possible, through acoustical deadening and close miking techniques. This allows each sound source to be treated independently, giving the recording engineer complete control over the quality of each instrument or voice. But this same technique destroys the natural ambience to which we are so accustomed, and leaves us with a very "dry" sound. To make the recording sound real again, to give it life, we must now add reverberation. And to capture the exact flavor demanded by a particular recording, we must have complete control over the quality of the reverb signal. That's what the 4400 Reverberation System is designed to do. It has all the functions you need to create the perfect reverb sound for any situation.

The actual reverberant quality of a room is determined by its size, shape and surface hardness. Very large

rooms have a more "bassy" sound, because their internal volume produces a lower resonant frequency. Very hard walls tend to reflect high frequencies more, while softer walls absorb them. Square rooms may echo, while odd shaped rooms produce a smoother reverb decay. These different qualities will actually determine the usefulness of a particular room. As an example, concert halls designed for classical music may not work at all for electric music. This is because every kind of music has its own personality, and demands its own kind of reverb. If it were possible to design a room whose very size, shape and hardness characteristics could be changed upon command, you would have the same kind of flexibility you get with the 4400. Each channel of the 4400 has its own four band graphic equalizer. This equalizer gives you the ability to adjust the quality of the reverb sound to perfectly match the rest of the music. You can actually create the sound of nearly any room — boosting the low end creates the illusion of a very large hall, while more high end sounds like a smaller room. This complete control capability allows you to really use the reverb, without ever having it sound phony or contrived. You can make the reverb sound so natural it almost goes unnoticed, and that's the idea.

Your 4400 Reverberation System is the only really usable low cost reverb unit on the market. It is designed to provide all the functions you need for studio recording, home recording, professional sound reinforcement and hi-fi use. If, after reading the Owner's Manual, you need more information, do not hesitate to contact your dealer or Tapco's Customer Service Department. The address and phone number are listed at the bottom of the Table of Contents page. We'll do everything we can to help you get the most from your 4400.





2. Block Diagram

(One channel shown)

This "road map" shows how the signals are routed within the 4400. As you read through the Owner's Manual, refer to this diagram to see how and where the various controls and circuits affect the sound.

The **System In/Out** switches send incoming signals to either the output jack, or to the AutoPad® **Input Level** control. The AutoPad® control allows you to match the gain of the 4400's input circuitry to the output level of the preceding equipment. The **Drive Level** meter reads the output of the AutoPad® stage, allowing you to optimize the levels at all times.

The **Input Mute** switch momentarily interrupts the incoming signals so that only the reverb decay is heard at the output. With this spring-loaded switch you can listen to the reverb decay alone as you fine tune the **Reverberation Equalizer** for the exact sound you need.

The ping-pong effect that has always identified the sound of a spring reverb is caused by sharp high energy pulses that actually over drive the reverb tank. The 4400's bi-level peak sampling circuits and dual differential constant current drive amplifiers have helped reduce the "spring slap" associated with most spring reverbs.

The *bi-level peak sampling circuit* detects high energy pulses that would over drive the reverb tank, and

automatically lowers the gain of the pre-driver circuit just enough to keep the signals within limits (without disturbing normal level signals). The sampling circuit gets its information from two different levels in the circuitry before the reverb tank — the pre-driver section, and the high frequency pre-emphasis section. Hence the term *bi-level peak sampling circuit*.

The *dual differential constant current drive amplifier* operates just like a small power amplifier. The constant current characteristic makes the amplifier act as if it were holding the reverb tank in a tight grip, smoothing out its irregularities and allowing the differential drivers to work more efficiently. To the drive amp's output, the input of the reverb tank looks just like a small speaker — that's why the 4400's drive circuits are really miniature power amplifiers.

The output of the reverb tank is fed to the four band **Reverberation Equalizer** (with specially selected center frequencies). With this equalizer you can create the sound of nearly any room — increasing the lows creates the illusion of a very large concert hall, while boosting the highs creates the sound of a small hard surfaced room like a tile bathroom.

The **Reverberation Percentage** mix controls govern the ratio of reverb sound and dry sound at the output, and the **Output Level** controls set the loudness of the overall signal at the outputs.

3. 4400 Control Functions

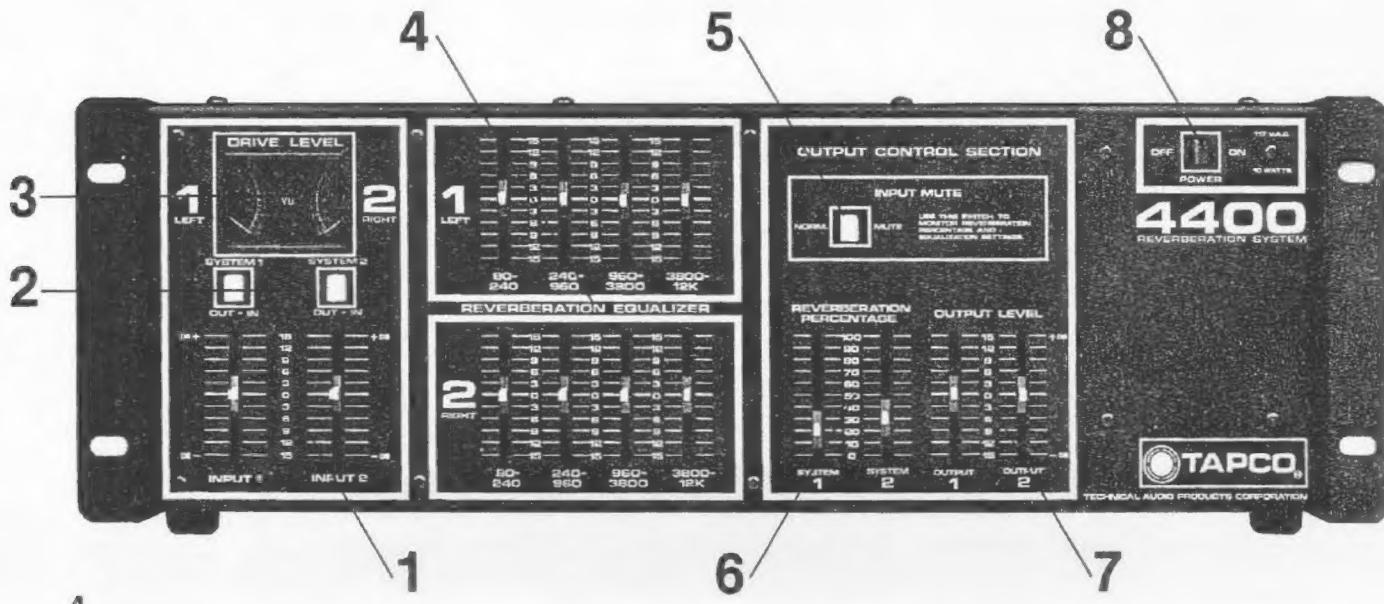
1. **INPUT LEVEL** controls are used to optimize the amount of energy applied to the reverb delay lines. Remember, the Input Level controls utilize Tapco's AutoPad® gain control circuitry, so the reverberation system can easily handle any input level from hi-fi or professional equipment. Don't be afraid to use the full range available from the Input Level controls when you need to. The 4400 will provide its best performance when the drive level meters are running right up around 0 VU.
2. **SYSTEM IN/OUT** switches direct the incoming signals to either the output jack (system "Out"), or to the Input Level AutoPad® volume control stage. For reverb set the switches to "In", for no reverb use the "Out" position.
3. **DRIVE LEVEL** meters measure the signal levels being fed to the pre-driver circuits. The meter is calibrated so a 0 VU reading corresponds to the optimum performance level throughout the system.
4. **REVERBERATION EQUALIZER** controls give you complete control over the tonal quality of the reverb signal only. The reverb EQ has no effect on the dry signal, and is not intended for use as a program equalizer. This special four band graphic was designed specifically for use on reverb signals. With the EQ controls you can simulate the reverberant qualities of nearly any room, and match the reverb quality of each individual piece of music.
5. **INPUT MUTE** momentarily interrupts the flow of signals into the 4400. When you are adding reverb by running your signals straight through the 4400, the Input Mute switch lets you hear the reverb decay by itself while you are adjusting the reverb equalization and percentage controls. When you hear the reverb decay alone you can really tell how it sounds, and how the equalizer and percentage controls can make it sound better.

When the 4400 is used in the effects send/receive loop of a mixer (like the Tapco 6200 A or B) the In-

put Mute switch can be used to evaluate the effect of the reverb on the composite signal. When the input is muted no reverb signal will be produced by the 4400, so only the dry signal will be heard from the mixer's outputs. When the switch is released the reverb will again be produced and fed back into the main signal via the effects returns. This way you can instantaneously compare the qualities of the signals both with and without the reverb.

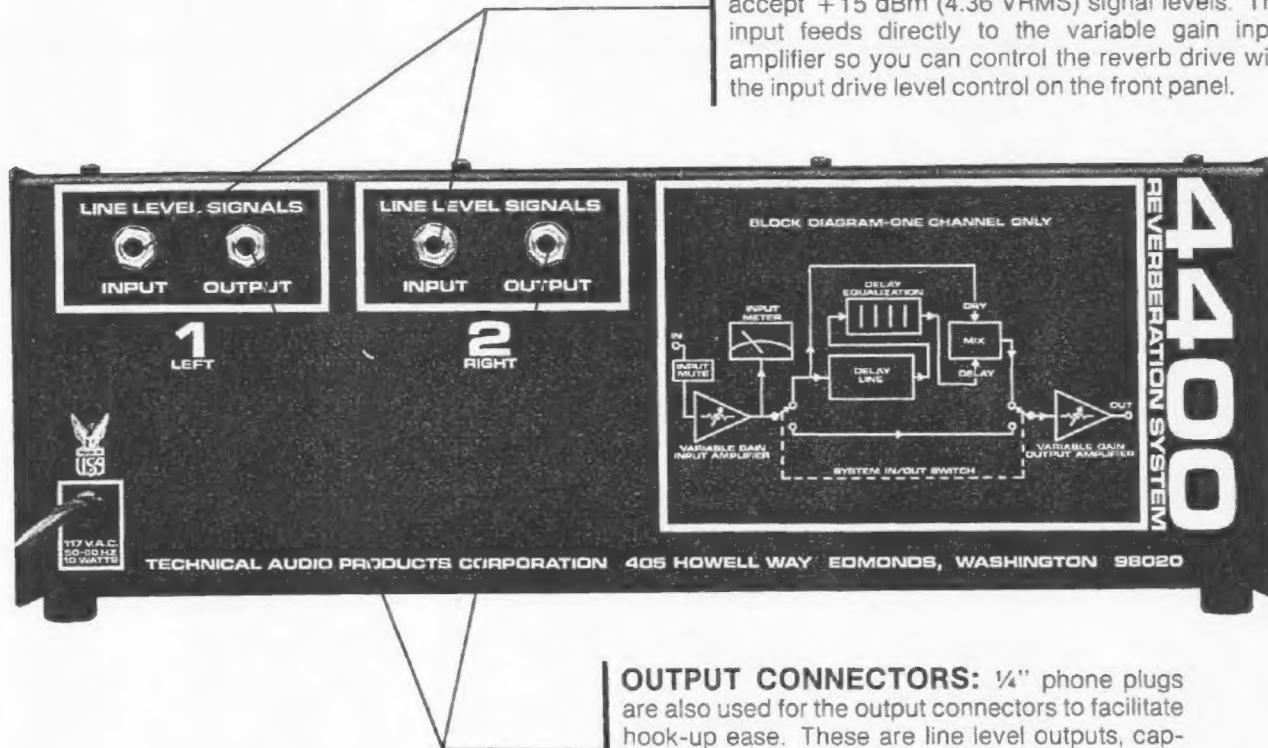
6. **REVERBERATION PERCENTAGE** mix controls set the amount of reverb that will be heard in the overall signal at the 4400's outputs. This control allows you to put the 4400 directly in the lines between your mixer and tape recorder (or any other line level equipment for that matter), or to put the 4400 in the effects send/receive loop. The reverb percentage mix controls should be set to 100% when the system is used in an effects loop. When it's used between the mixer and recorder, the controls should be set for just the right amount of reverb in the total signal — usually no more than 50%.
7. **OUTPUT LEVEL** controls govern the loudness of the 4400's output signals. In most cases these controls will be used to adjust the overall gain of the reverb system to unity (no change). Switch the In/Out switches back and forth, and compare the levels with the system in and out. Then adjust the Output Level controls so the volume is the same no matter how the switches are set. However, if it's necessary to change the output level so equipment that follows the 4400 is not overloaded, or to give following equipment enough level to work with, make this change with the Output Level controls. Do not attempt to get more output level by increasing the input level!!! You may get distortion from the input circuits if you do. But don't be afraid to use the output gain if you need it — these are AutoPad® volume controls.

8. POWER — ON/OFF



4. 4400 Input and Output Connections

The 4400 is designed to be used with line level signals only! As a general rule, if the input level to the 4400 isn't hot enough to deflect the meters to 0 VU (even with the input level controls fully boosted), then it's not line level.



INPUT CONNECTORS: $\frac{1}{4}$ " phone plugs are provided to allow you easy hook-up to most audio equipment. These are line level inputs which will accept +15 dBm (4.36 VRMS) signal levels. The input feeds directly to the variable gain input amplifier so you can control the reverb drive with the input drive level control on the front panel.

OUTPUT CONNECTORS: $\frac{1}{4}$ " phone plugs are also used for the output connectors to facilitate hook-up ease. These are line level outputs, capable of 10 volts RMS into a 5000 ohms or greater load. Signal strength is controlled by the output level controls on the front panel.

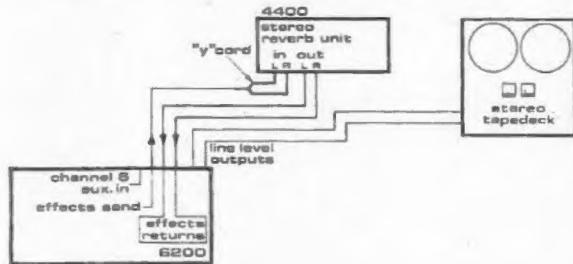
NOTES:

5. How To Use The 4400

There are really two basic ways to hook up the 4400: 1) *In the effects send/receive loop of a mixer,* or 2) *Straight through, in the lines between the mixer and tape recorder (or what have you).* Of course, the separate effects loop hook up offers more precise control over the amount of reverb added from the sound of each input channel. But for those systems that are not equipped with an effects buss, the 4400 has built-in Reverberation Percentage mix controls so you can add just the right amount of reverb to the overall sound.

The effects send output of the mixer is connected to the reverb system. Whenever your final mix is going to be stereo, use a Y-cord to connect the effects output to both channels of the reverb. The two reverb outputs are then run back into the mixer through their respective effects return jacks. The stereo image created by the reverberation itself is very spacious when the signal is split like this. The effect of separation can be further increased by using slightly different reverb EQ on each channel of the 4400 — try a few different settings to see what happens.

Hook Up to the Effects Send/Receive Loop



How to set it up:

- 1 Set the input and output level controls at "O", System In/Out switches "In," Reverberation Equalizer controls to "O," and Reverberation Percentage controls to 100%.
- 2 Before feeding any signals to the reverb unit, establish your basic mix. (Some settings may have to change later, but a good basic mix is the foundation.)
- 3 Set the effects return controls on the mixer at about half volume.
- 4 Slowly advance the effects send controls on any channel to which you want to add reverb, until you get the amount of reverb you want.
- 5 Now, balance the input and output levels on the 4400 by increasing the input level controls so the meters peak at O VU, and then re-set the output level controls for the amount of reverb you wanted. Setting the input levels for O VU will get the best performance from the 4400, and re-setting the output levels will match the 4400's output level to the sensitivity of the mixer's effects return circuit.
- 6 Use the Input Mute switch to cut off the reverb when you want to compare your program material both with and without reverb added.

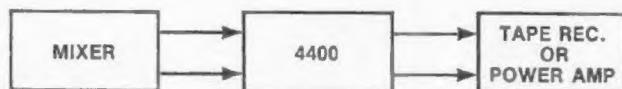
Straight Through Hook Up

The line outputs of the mixer (preamp, etc.) are connected to the inputs of the 4400, and the 4400's outputs are run to the line inputs of tape machine (power amp, etc.).

How to set it up:

- 1 Set the input and output levels on the 4400 to "—10," Reverberation Percentage controls to "O." (This will prevent the signals from being too loud at first. Beware!)
- 2 Now feed your signals into the 4400 and adjust the input level controls so the meters peak at O VU.
- 3 Increase the output level to a comfortable listening level, then increase the Reverberation Percentage controls until you get just the right amount of reverb.
- 4 Adjust the Reverberation Equalizer controls for the best sound. (You may have to re-adjust the percentage controls.)
- 5 Switch the Input Mute switch to temporarily interrupt the incoming signal — you will hear the reverb decay by itself. This allows you to judge the reverb sound on its own merits for easier evaluation. By alternately adjusting the EQ and muting the input, you will very quickly find the best combinations of reverb EQ and percentage controls for any program material.

Hook-up between mixer and recorder (or power amp):



Connect the line outputs of the mixer to the inputs of the 4400, and the outputs of the 4400 to the line inputs of the tape recorder.

6. References

Where to get more information

Modern Recording Techniques by Robert Runstein, published by Howard W. Sams Co. The complete modern text book of studio recording techniques.

Modern Recording is a bi-monthly magazine from the Recording Institute of America. MR covers equipment techniques, actual studio sessions, etc., This magazine is highly recommended to anyone interested in recording.

Modern Recording
Recording Institute Publishing Inc.
15 Columbus Circle
New York, N.Y. 10023

Recording Engineer/Producer is another very good bi-monthly magazine dealing with the recording arts.

Recording Engineer/Producer
P.O. Box 2449
Hollywood, CA 90028

Basic Audio by Norman Crowhurst, is available from the John F. Rider Publishing Company. This book is just what the title implies.

Microphone Primer by Jim Long available from Electro-Voice, 600 Cecil Street, Buchanan, Mich. 49107. The basic guide to microphones.

The following are available from:

Sagamore Publishing Co. Inc.
1120 Old Country Road
Plainview, N.Y. 11803

DB Magazine — an authoritative, well known magazine, dealing with recording, sound reinforcement and general audio topics. Monthly.

Microphones: Design and Application by Lou Burroughs. The author was one of the two original founders of Electro-Voice, Inc. He is responsible for a great deal of today's accepted microphone theory and design. The book is a practical, non-theoretical reference manual for anyone in the audio industry.

The Technique of the Sound Studio by Alec Nisbett. This is a handbook on radio and recording techniques, but the principles described are equally applicable to film and television sound. 264 pages; 60 diagrams; glossary, indexed.

Modern Sound Reproduction by Harry F. Olson. This basic text covers amplifiers, microphones, loudspeakers, earphones, tape systems, film sound, tv and sound reinforcement — the significant elements and systems of modern sound reproduction. Employs simple physical explanations which are easily understood without special engineering training. 328 pages.

We might suggest that instead of investing your hard earned bucks in any of these publications on our word alone, go down to your library and look them over first. That much, at least, is free.

7. 4400 Specifications

GENERAL	
Frequency Response (straight through)	10 Hz to 25 kHz ± dB (-3dB@ 40kHz)
HARMONIC Distortion (straight through)	.05% at +10dBm output
IM Distortion (straight through)	.05% at 25 volts P-P output
S/N Ratio (straight through)	better than 80dB, Ref: 1 volt in/out
S/N Ratio (50% Reverb mix, equalization set flat, level controls at unity)	70 dB Ref: 1 volt in/out at 4,000 Hz
Power requirements	117 volts AC, 60 Hz, 10 watts nominal (may be rewired for 220 v.a.c. by internal connection)
Dimensions	6.5" high, 19" wide, 9.3" deep
Weight	12½ pounds
OUTPUTS	
Maximum output level	+15dBm into 600 ohms 10 volts RMS into 5000 ohms or greater
Output impedance	100 ohms
INPUTS	
Maximum input level	+15dBm average, +20dBm on program peaks
Input impedance	20K ohms
REVERB SECTION	
Reverberation system	Delay: 30 milliseconds Decay: -60dB at 1.9 seconds
Reverb section frequency response	adjustable
Reverberation equalizer	+15dB, four bands
Mix ratio	adjustable from no reverb (straight through) to 100% reverb

ADDENDA SHEET FOR 4400A

The 4400A is an updated version of the 4400. The principal changes are:

1. The reverb tanks have been changed to Accutronics Type 9. These have 3 springs in the delay channel and offer vastly improved sound.
2. The pre and post equalization in the drive and pickup circuitry has been revised to optimize them for the new reverb tanks.
3. The input jacks are normalled. This facilitates operation in the one in two out mode without the use of wye (Y) cords.

Operation of the 4400A is the same as the 4400. The 4400A is at its best when used in the mono send stereo return situation. Plug the effects or other send into the 4400A channel one input. The internal normal connection on the input jacks will tie the two channels together (at the input only). Take the two outputs and patch them to two effects returns or inputs and pan them oppositely (hard left and hard right). Make sure that the reverberation percentage control is at 100% and that the reverb EQ controls have relatively identical settings. Make reverb intensity adjustments with the output level controls or at the board.

Additionally, if you have some form of delay available (digital or analog delay line or a 3 head tape machine) you can use this to further improve the sound of your 4400A. Patch the reverb or echo send of your board into the input of the delay unit. Patch the delay unit output into the 4400A input. Adjust the delay unit for somewhere between 30 and 100 milliseconds of delay. Sometimes a good effect can be obtained by adjusting the delay time so that the first reverb reflection occurs on the backbeat. Make sure that your levels are correct for both the delay device and the 4400A.

Of course, the 4400A can still be used as a two channel (independent) reverb unit. Just use both input jacks and both output jacks. That's all there is to it.

If you own a 4400, rather than a 4400A, the above patches can still be used. The only thing that is different is that you will need a wye (Y) cord to patch the two inputs together. Other than that, all other procedures and functions are the same.